



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/517,575

12/09/2004

Victor Lu

H0004019 (4780)

1366

62993

7590

02/11/2008

BUCHALTER NEMER
18400 VON KARMAN AVE.
SUITE 800
IRVINE, CA 92612

EXAMINER

SMOOT, STEPHEN W

ART UNIT

PAPER NUMBER

2813

MAIL DATE

DELIVERY MODE

02/11/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/517,575	Applicant(s) LU ET AL.	
	Examiner Stephen W. Smoot	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 September 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☒ Claim(s) 22 and 23 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 December 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office action is in response to applicant's response filed on 26 September 2007.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 7 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

A broad range together with a narrow range that falls within the broad range (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). In the present instance, claim 7 recites the broad recitation "from about 0.1% to about 13%", and the claim also recites "about 10% or less" (see claim 1, line 5) which is the narrower statement of the range.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnade et al. (EP 0 687 004 A1 – from applicant's IDS).

Referring to Figs. 1-2 and page 4, line 9 to page 7, line 58, Gnade et al. disclose a low dielectric constant multilayer dielectric structure that includes the following structural features:

- An insulating layer (22) (i.e. a substrate);
- A porous dielectric layer (28) with a porosity that is greater than 50% and with a dielectric constant that is less than 2.0 formed on the insulating layer (22) (also see page 9, lines 9-16);
- In a specific example, the porous dielectric layer (28) is about 80% porous and has a dielectric constant that is less than 1.5 (see page 4, lines 42-45);
- A less porous dielectric layer (29) with a porosity that can range from 15% to 50% formed on the porous dielectric layer (28);
- A non-porous capping layer (30) formed on the less porous dielectric layer (29);

- The capping layer (30) can be silicon dioxide (see page 4, lines 38-41), which has a dielectric constant of about 3.9 (also see page 2, line 20-22).

These are structural limitations as set forth in claims 1-3, 11-12, 15 of the applicant's invention.

Regarding claims 4-5, 8-9, Tsui et al. (US 6,208,030 B1) is submitted as evidence to show that silicon dioxide with a porosity of 15 % has a dielectric constant of about 3.5, while silicon dioxide with a porosity of 48 % has a dielectric constant of about 2.5 (see column 6, lines 1-5).

Regarding claims 6, 10, the porous layers (28, 29) are formed from TEOS-based precursors, which implies that both layers include silicon oxide.

Regarding claim 13, Figs. 3A-3D of Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) indicate that the thickness of the less porous dielectric layer (29) can be about 10 % to about 50 % of the total thickness, which corresponds to a ratio that ranges from 0.1 to 0.5.

However, Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) lack the limitation of the less porous dielectric layer having a porosity of about 10 % or less (a limitation of claim 1) and the limitation of the less porous dielectric having a porosity that ranges from about 0.1 % to about 13 % (the limitation of claim 7).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the low dielectric constant multilayer dielectric structure of Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) to include a less porous dielectric layer with a porosity of about 10 % or less through routine experimentation in

order to discover the workable ranges of their structure, unless the applicant can show that the as-claimed porosity ranges are critical to the invention [see *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA)]. It is noted that claim 7, which limits the maximum porosity to about 13 %, indicates that an upper limit of about 10 % porosity is not critical to the applicant's invention.

Regarding claim 14, the adherence of the multilayer structure of Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) is presumed to be sufficient to pass the ASTM D 3359-97 test because their structure is substantially identical to the applicant's as-claimed structure and, accordingly, the burden is shifted to the applicant to show otherwise per MPEP section 2112.01.

5. Claims 16-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) in view of Gallagher et al. (US 6,596,467 B2).

Referring to Figs. 1-2 and page 4, line 9 to page 7, line 58, Gnade et al. disclose a method for forming a low dielectric constant multilayer dielectric structure that includes the following features:

- An insulating layer (22) (i.e. a substrate);
- A porous dielectric layer (28) with a porosity that is greater than 50% formed on the insulating layer (22) (also see page 9, lines 9-16);
- In a specific example, the porous dielectric layer (28) is about 80% porous (see page 4, lines 42-45);

Art Unit: 2813

- A less porous dielectric layer (29) with a porosity that can range from 15% to 50% formed on the porous dielectric layer (28);
- Both porous dielectric layers (28, 29) are formed using a TEOS precursor (ie an ethoxysilane pre-polymer) and using ammonium hydroxide as an additive to increase the gelation rate (i.e. a metal-ion-free onium compound);
- The porous dielectric layers (28, 29) are formed by drying (i.e. heating) gel sublayers (25, 26); and
- A non-porous capping layer (30) formed on the less porous dielectric layer (29).

These are limitations as set forth in claims 16-18, 20 of the applicant's invention.

Regarding claim 21, Figs. 1-2 do not indicate any infiltration between the two porous layers (28, 29).

However, Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) lack the limitations of the less porous dielectric layer having a porosity of about 10 % or less and the inclusion of a porogen in the first composition (both are limitations of claim 16). Further, Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) lack the further limitation to claim 16 as set forth in claim 19, which is a group of compounds that the porogen is selected from.

Gallagher et al. teach the formation of a porous layer using TEOS-containing organo polysilicas as the dielectric matrix and a removable porogen that can be a functionalized aliphatic ester for defining pores that are formed by heating (see column 5, lines 21-44 and column 6, line 14 to column 7, line 50).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) and Gallagher et al. in order to form the first porous layer (28) of Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) by utilizing a porogen that contains functionalized aliphatic ester, as taught by Gallagher et al. Gallagher et al. show that using porogen has an art recognized equivalence to the method disclosed by Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) for forming a porous layer.

It also would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the low dielectric constant multilayer dielectric structure of Gnade et al. (EP 0 687 004 A1 – from applicant's IDS) and Gallagher et al. to include a less porous dielectric layer with a porosity of about 10 % or less through routine experimentation in order to discover the workable ranges of this combination, unless the applicant can show that the as-claimed porosity limitation of about 10 % or less is critical to the invention [see *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA)].

Response to Arguments

6. Applicant's arguments, see pages 2-6, filed on 26 September 2007, with respect to the rejection of claims 1-23 under 35 USC 103(a) have been fully considered and are persuasive. Therefore, the prior art rejections have been withdrawn. However, upon

further consideration, new grounds of rejection are made in view of Gnade et al. (EP 0 687 004 A1 – from applicant's IDS).

Allowable Subject Matter

7. Claims 22-23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter: Claims 22-23 would be allowable because the prior art of record does not teach or suggest, in combination with the other claim limitations, a method for forming a multilayered dielectric structure that includes coating a substrate with a first composition that comprises a pre-polymer and a porogen to produce a porous dielectric with a porosity of about 10% or more, coating the porous dielectric layer with a second composition that comprises a silicon containing pre-polymer to produce an adhesion promoting dielectric layer with a porosity of about 10% or less, and forming a substantially nonporous capping layer on the adhesion promoting dielectric layer, wherein the first composition and the second composition include a silicon containing pre-polymer selected from the group consisting of tetraacetoxysilane, a C₁ to about C₆ alkyl or aryl-triacetoxysilane, and combinations thereof.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on Monday to Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Stephen W Smoot/
Primary Examiner
Art Unit 2813

Application/Control Number: 10/517,575
Art Unit: 2813

Page 10